INSTRUCTION MANUAL

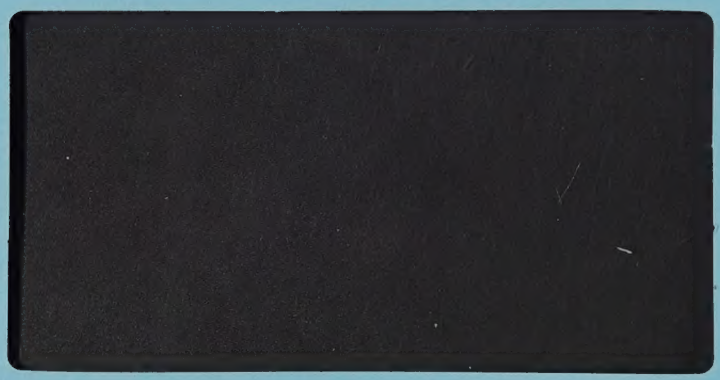
REGULATED POWER SUPPLIES

LGS-6V SERIES

MP MASTER
MA28623

LAMBDA

LAMBDA ELECTRONICS MELVILLE, L. I., N. Y.



INSTRUCTION MANUAL

FOR

REGULATED POWER SUPPLIES

LGS-6V SERIES

This manual provides instructions intended for the operation of Lambda power supplies, and is not to be reproduced without the written consent of Lambda Electronics. All information contained herein applies to all LGS-6V models unless otherwise specified.

LAMBDA ELECTRONICS

MELVILLE, L.I., N.Y.

MAIN PLANT TELEPHONE: MYrtle 4-4200

GE-7788-8

IM-LGS-6V

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SPECIFICATIONS AND FEATURES

DC OUTPUT — Voltage regulated for line and load. See table I for voltage and current ratings.

TABLE I
VOLTAGE AND CURRENT RANGES

MODELS	VOLTAGE RANGE	MAXIMUM CURRENT (AMPS) AT AMBIENT TEMPERATURE			
		40°C	50°C	60°C	71°C
LGS-6V-5-OV-R	5 ± 5%	63.0	55.0	46.0	34.2
LGS-6V-6-OV-R	6 ± 5%	54.0	50.4	44.1	32.4
LGS-6V-12-OV-R	12 ± 5%	34.0	31.5	27.4	20.7
LGS-6V-15-OV-R	15 ± 5%	27.0	25.2	22.0	18.4
LGS-6V-20-OV-R	20 ± 5%	20.7	19.3	16.6	13.9
LGS-6V-24-OV-R	24 ± 5%	18.0	17.1	14.4	11.7
LGS-6V-28-OV-R	28 ± 5%	15.7	14.8	13.0	10.8

Current range must be chosen to suit the appropriate maximum ambient temperature. Current ratings apply for entire voltage range.

REGULATED VOLTAGE OUTPUT

Regulation ..... 0.1% line or load with input variations from 187-242, 242-187, 205-265, or 265-205 volts AC and load variations from no load to full load.

Ripple and Noise ..... 10mV RMS, 35mV peak-to-peak for LGS-6V-5-OV-R, -6-OV-R models; 15mV RMS, 100mV peak-to-peak for LGS-6V-12-OV-R, -15-OV-R, -20-OV-R, -24-OV-R, and -28-OV-R with either positive or negative terminal grounded.

Temperature Coefficient ..... Change in output voltage 0.03%/°C max.

Remote Programming

External Resistor ..... Nominal 1000 ohms/volt output.

Programming Voltage ..... One-to-one voltage change.

Remote Sensing ..... Provision is made for remote sensing to eliminate effect of power output lead resistance on DC regulation.

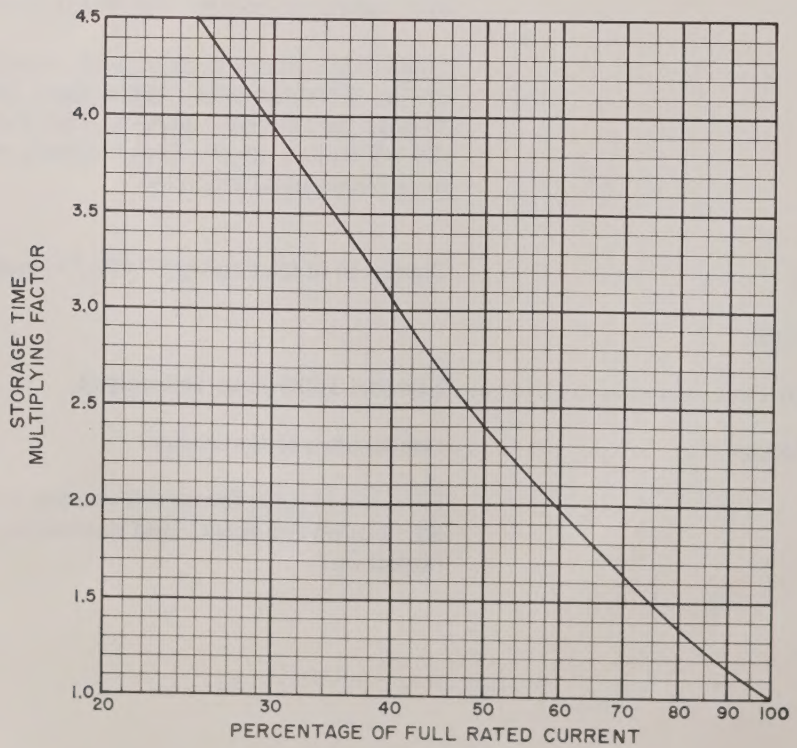
STORAGE TIME — Determine storage time regulation after input power failure as follows:

1. Find storage time at full rated current from chart below.
2. Determine percentage of full rated current for desired application.
3. Find multiplying factor on graph below.
4. Apply storage time formula:

$$S = (F)\ (M)$$

where S = storage time
F = storage time at full rated current (see chart)
M = multiplying factor (see graph)

MODEL	STORAGE TIME (ms) AT FULL RATED CURRENT
LGS-6V-5-OV-R	24.0
LGS-6V-6-OV-R	23.0
LGS-6V-12-OV-R	7.0
LGS-6V-15-OV-R	8.0
LGS-6V-20-OV-R	10.0
LGS-6V-24-OV-R	8.0
LGS-6V-28-OV-R	8.0



OVERSHOOT — No overshoot under conditions of power turn-on, turn-off, or power failure.

AC INPUT — 187-242 or 205-265 VAC, 47-440 Hz. See nameplate for AC input rating. Input power 660 Watts*. Input current 4.5 Amps**. For operation at frequencies above 440 Hz, consult factory.

*With output loaded to full current rating.
**With output loaded to full current rating and minimum rated input voltage.

INPUT FUSE — Fuse F1 protects the input wiring to the power supply. Overload of power supply does not cause fuse failure.

OVERLOAD PROTECTION

Thermal ..... Thermostat resets automatically when overtemperature condition is eliminated.

Electrical ..... Automatic electronic current limiting circuit, limits output current to a preset safe value. Automatic current limiting protects the load and power supply when external overloads and direct shorts occur.

OVERVOLTAGE PROTECTION — All LGS-6V models include fixed built-in overvoltage protection circuits which prevent damage to the load caused by excessive power supply output voltage. See table below for overvoltage protector firing ranges.

MODEL	OVERVOLTAGE PROTECTOR TRIP-POINT RANGE (VOLTS)
LGS-6V-5-OV-R	6.4 — 6.8
LGS-6V-6-OV-R	7.1 — 7.5
LGS-6V-12-OV-R	13.3 — 14.1
LGS-6V-15-OV-R	16.5 — 17.5
LGS-6V-20-OV-R	22.1 — 23.5
LGS-6V-24-OV-R	26.5 — 28.1
LGS-6V-28-OV-R	30.9 — 32.9

INPUT CONNECTIONS — Terminal block on front of chassis.

OUTPUT CONNECTIONS — 1/4 - 28 studs on front of chassis.

OPERATING AMBIENT TEMPERATURE RANGE AND DUTY CYCLE — Continuous duty from 0°C to 71°C ambient with corresponding load current ratings for all modes of operation.

STORAGE TEMPERATURE (non operating) — -55°C to 85°C

FUNGUS — All LGS-6V power supplies are fungus inert.

VDC ADJ. Control — Voltage adjust control permits adjustment of DC output over entire operating range.

PHYSICAL DATA

Size	3-3/16" x 7-1/2" x 15-1/8"
Weight	21.0 lbs. net; 24.0 lbs. shipping
Finish	Gray, FED. STD. 595 No. 26081

MOUNTING — One surface, with tapped mounting holes can be utilized for mounting this unit. LGS-6V power supplies must be mounted with Top facing up and in a horizontal plane. Refer to figure 10 for mounting details.

ACCESSORIES

Rack adapters	Rack adapters LRA-7, LRA-8, LRA-11, LRA-14, LRA-15, LRA-16, and LRA-17, used for ruggedized mounting with or without chassis slides, are available.

GENERAL

The Lambda power supply consists of an input circuit; an auxiliary rectifier and filter; a main output rectifier; and a main regulator circuit consisting of timing oscillator, flip-flop, comparator, nor gates, control and current limit amplifiers, and pulse width modulated inverter.

The circuit arrangement is shown in block diagram form in figure 8. The circuitry is discussed with reference to the block diagram and the schematic diagram.

FUNCTIONAL DESCRIPTION

Input Circuit

Single phase AC input power is applied to input bridge rectifiers SCR5, SCR6, CR7, CR8 via EMI suppression network C20, C21, C18, C22, C16, C15, C17, L3, L4. Fuse F1 protects the power supply against excessive currents due to internal failure.

The input rectifier and filter capacitors C1, C2 provide power via R2, R1, C104, and CR129 for the logic circuitry and provide power to the pulse width moudlated inverter.

On initial turn-on, capacitors C1, C2 are charged via CR103, R15, and CR144. Capacitor C107 is charged via R113. When the voltage on C107 exceeds the zener breakdown voltage of CR141, CR141 conducts, turning on control amplifier HC101 which, in turn, turns on the pulse width modulated inverter. The pulse width modulated inverter supplies gate voltage to SCR5 and SCR6 via CR5 and CR6. This action serves to prevent excessive in-rush current when unit is turned on.

Pulse Width Modulated Inverter

Positive and negative pulses are provided to the primary of T1 by the alternate conduction of Q1, Q3 and Q2, Q4. The duration of these pulses is determined by the conduction time of Q1, Q2, Q3 and Q4. This time is determined by the duration of the drive pulses applied to the bases of Q101 and Q102 by IC103.

When Q101 is turned on, voltage will be applied to the base of Q1 via C125, CR105, R204, CR108, CR110, and R133 turning Q1 on. Current flow through T203A causes a voltage to be developed across T203B. This voltage turns on Q3. The voltage developed across T203C compensates for the loss of drive due to the voltage across T203A. As current through C125 decays, regenerative action holds Q1 on by providing base drive via CR10, CR9, CR150, CR151, CR152, CR153, R10, feedback winding of T1, CR115, and CR133. Diode CR118 prevents saturation of Q1 which would extend turn-off time. Resistor R101 provides sufficient current to keep Q103 and Q105 off.

When Q101 is turned off, C105 provides voltage to turn on Q103 which, in turn, turns on Q105. C101, C106 supply negative bias to the base of Q1 via Q105, R133. This action rapidly turns off Q1 and holds it off.

A similar sequence of events serves to turn Q2 and Q4 on and off as Q102 is turned on and off.

Output Circuit

Positive and negative pulses supplied by T1 secondary are rectified by full wave rectifiers CR1 and CR2; filtered by filter network C3, L1 and supplied to the output via E.M.I. suppression network C8, C9, C13, C14, L2, L9, L10, L11, L12.

Logic and Control Circuits

IC101 is a free running timing oscillator. The output, pin 3, of IC101 is high for 23 microseconds and low for 5 microseconds resulting in an overall period of 28 microseconds. The output of IC101 is fed into flip-flop IC102. IC102 is triggered by the leading edge of the IC101 output resulting in square waves having periods of 56 microseconds at the Q and $\overline{Q}$ (pins 1 and 2) outputs of IC102. Each square wave serves as one input to one of two nor gates located within IC103. The other input of each gate is provided by internal circuitry within IC103 connected as an amplitude comparator at pin 1 of IC103. Pin 1 of IC103 is controlled by the output of the hybrid control amplifier HC101.

HC101 control output is determined by changes in output voltage as sensed via L7, voltage control R19, and resistor R119. If the output voltage tends to decrease, current from pin 6 output of HC101 is delayed thereby delaying the charging of C119 and delaying the high input to pin 1 of IC103. This action delays the turning off of the drive output to Q101 or, as applicable Q102. When IC101 pin 3 goes low, the voltage at IC103 pin 1 is reset via CR126. The connection from IC101 pin 3 to IC103 pins 5 and 6 via CR127 serves to prevent Q101 and Q102 from being turned on while the timing oscillator is in the low state. This sequence is shown in the following truth table:

IC101	IC102		IC103			
TIMING OSCILLATOR	FLIP-FLOP OUTPUTS		INPUT	DRIVE OUTPUTS		REMARKS
Pin 3	Pin 1	Pin 2	Pin 1	Pin 10	Pin 11	
low	low	high	low	low	low	inverter dead period
high	low	high	low	high	low	drive Q101
high	low	high	high	low	low	inverter quiescent period
low	high	low	low	low	low	inverter dead period
high	high	low	low	low	high	drive Q102
high	high	low	high	low	low	inverter quiescent period
low	low	high	low	low	low	inverter dead period

Current Limit Operation

As the load current tends to increase, the inverter current increases, thereby increasing the voltage across resistor R5. This voltage is sensed by hybrid control amplifier HC101. The result is the progressive hastening of the current output from HC101 pin 6 and therefore, drive current to Q101 or, as applicable, Q102 is turned off sooner and sooner until the conduction time of the inverter becomes less than 3 microseconds.

The following paragraph applies only to models LGS-6V-12-OV-R through LGS-6V-28-OV-R.

As HC101 goes into current limit mode, it begins to draw current at pin 8 via resistors R121 and R122, turning on Q107. This, in turn, turns on Q108. C112 is charged via Q108 and R140. When the timing oscillator is in the low state, C112, as well as C118, discharges. This additional capacitance extends the oscillator low time. This action serves to further limit the output current.

As load impedance approaches short circuit the load current is held relatively constant.

Overvoltage Circuit Operation

When the output voltage reaches the trip-point of the hybrid overvoltage module, the module fires crow-barring the output of the supply. The current through the module is sensed by current sensor L8. The output of L8 triggers SCR101, crow-barring the logic circuitry and turning the inverter off.

BASIC MODE OF OPERATION

This power supply operates as a constant voltage source provided the load current does not exceed the rated value at 40° C. For continuous operation, load current must not exceed the rating for each ambient temperature. When rated load current is exceeded, voltage decreases towards zero and the current at short circuit is held to a safe value.

CONNECTIONS FOR OPERATION

NOTE: Make all connections to the unit before applying input power.

Ground Connections. The Lambda power supply can be operated either with negative or positive output terminal grounded. Both positive and negative ground connections are shown in the diagrams for all suggested output connections illustrated in this manual.

Connection Terminals. Make all connections to the supply at the terminal block and power studs on the front of the supply. Apply input power to terminals 1 and 2; always connect the ungrounded (hot) AC lead to terminal 1.

The supply positive terminal is brought out to terminal 6. The supply negative terminal is brought out to terminal 4. Recommended wiring of the power supply to the load and selection of wiring is shown in figures 1 through 9. Selection of proper wiring is made on the basis of load requirements. Make all performance checks and measurements of current or voltage at the front output terminals. Connect measuring devices directly to terminals or use the shortest leads possible.

SUPPLY LOAD CONNECTIONS

Connections for Operation as a Constant Voltage Source

The output impedance and regulation of the power supply at the load may change when using the supply as a constant voltage source and connecting leads of practical length are used. To minimize the effect of the output leads on these characteristics, remote sensing is used. Recommended types of supply-load connections with local or remote sensing are described in the following paragraphs.

Refer to figure 1 to determine voltage drop for particular cable length, wire size and current conditions. Lead lengths must be measured from supply terminals to load terminals as shown in figure 2.

Local Sensing Connection, Figure 3. Local sensing is the connection suitable for applications with relatively constant load or for applications with short power output leads.

Remote Sensing Connection, Figure 4. Remote sensing provides complete compensation for the DC voltage drops in the connecting cables. Sensing leads should be a twisted pair to minimize AC pick-up. A 2.5 mf elect., capacitor may be required between output terminals and sense terminals to reduce noise pick-up.

Programmed Voltage Connections, Using External Resistor, Figure 5. Discrete voltage steps can be programmed with a resistance voltage divider valued at a nominal 1000 ohms/volt change and a shorting-type switch as shown in figure 5. When continuous voltage variations are required, use a variable resistor with the same 1000 ohms/volt ratio in place of the resistive voltage divider and shorting-type switch. Use a low temperature coefficient resistor to assure most stable operation.

Before programming, adjust programming resistor for zero resistance and set voltage adjust control to the minimum rated output voltage. Output voltage of programmed supply will nominally be minimum output voltage plus 1 volt per 1000 ohms.

As shown in figure 5, voltages can be programmed utilizing either local or remote sensing connections, as desired.

Programmed Voltage Connections Using Programming Voltage, Figure 6. The power supply voltage output can be programmed with an externally connected programming power supply. The output voltage change of the programmed supply will maintain a one-to-one ratio with the voltage of the programming supply. If the output voltage control of the programmed supply is set to minimum output voltage, output voltage of the programmed supply will be minimum output voltage plus voltage of programming supply.

The programming supply must have a reverse current capability of 1 ma. minimum.

Alternatively, when supplies with less than 1 ma. reverse current capability are used, a resistor capable of drawing 1 ma. at the minimum programming voltage must be connected across the output terminals of the programming supply. This programming supply must be rated to handle all excess resistor current at the maximum programming voltage.

Connections For Series Operation, Figure 7.

The voltage capability of LGS-6V power supplies can be extended by series operation. Figure 7 shows the connections for either local or remote sensing in a series connection where the voltage control of each unit functions independently to control the output.

A diode, having a current carrying capability equal to or greater than the maximum current rating of the supply, must be used and connected as shown in figure 7. The diode blocking voltage should be at least twice the maximum rated output voltage of the supply. See table I, of SPECIFICATIONS AND FEATURES, for power supply current and voltage ratings.

OPERATION AFTER PROTECTIVE DEVICE SHUTDOWN

Thermostat Shutdown. The thermostat shuts down inverter operation only when the temperature of the main rectifier heat radiator exceeds a maximum safe value. The thermostat will automatically reset when the temperature of the heat sink decreases to a safe operating value.

Fuse Shutdown. Fuse will blow when the maximum rated current value for the fuse is exceeded. Fatigue failure of fuses can occur when mechanical vibrations from the installation combine with thermally induced stresses to weaken the fuse metal. Many fuse failures are caused by a temporary condition and replacing the blown fuse will make the fuse protected circuit operative.

Overvoltage Shutdown. When the power supply output voltage increases above the overvoltage limit, HC1 will short circuit output of the supply and SCR101 will shut down inverter operation. After eliminating the cause(s) for overvoltage, resume operation of the supply by interrupting the AC input circuit for a period of twenty seconds. (refer to TROUBLE SHOOTING CHART)

GENERAL

This section describes trouble analysis routine, calibration and test procedures that are useful for servicing the Lambda power supply. A trouble chart is provided as an aid for the troubleshooter. Refer to the section on SPECIFICATIONS AND FEATURES for the minimum performance standards.

OPENING UNIT FOR TROUBLESHOOTING AND REPAIR

Whenever it is necessary to troubleshoot and repair the Lambda LGS-6V power supply, open the unit as follows:

1. Remove top cover by removing 12 screws along edge of cover.

2. Remove wrap-around bottom cover along with attached components by removing 13 screws along edge of cover.

3. Power supply components are now accessible for troubleshooting and repair.

TROUBLE ANALYSIS

Whenever trouble occurs, systematically check all fuses, primary power lines, external circuit elements, and external wiring for malfunction before troubleshooting the equipment. Failures and malfunctions often can be traced to simple causes such as improper jumpers and supply-load connections or fuse failure due to metal fatigue.

Use the electrical schematic diagram and block diagram, figure 8, as an aid to locating trouble causes. The schematic diagram contains various circuit voltages that are averages for normal no load operation. Measure these voltages using the conditions for measurement specified on the schematic diagram. Use measuring probes carefully to avoid causing short circuits and damaging circuit components.

CHECKING TRANSISTORS AND CAPACITORS

Check transistors with an in-circuit transistor checker. If no checker is available, transistors can be checked with an ohmmeter that has a highly limited current capability. Observe proper polarity for PNP or NPN to avoid error in measurement. The forward transistor resistance is low but never ZERO; backward resistance is always higher than the forward resistance.

Do not assume trouble is eliminated when only one part is replaced. This is especially true when one transistor fails, causing other transistors to fail. Replacing only one transistor and turning power on, before checking for additional faulty components could damage the replaced component.

When soldering semi-conductor devices, hold the lead being soldered with a pair of pliers or a commercial heat sink device placed between the component and the solder joint.

NOTE: The leakage resistance obtained from a simple resistance check of a capacitor is not always an indication of a faulty capacitor. In all cases the capacitors are shunted with resistances, some of which have low values. Only a dead short is a true indication of a shorted capacitor.

PRINTED CIRCUIT BOARD MAINTENANCE TECHNIQUES

1. If foil is intact, but not covered with solder, it is a good contact. Do not attempt to cover with solder.

2. Voltage measurements can be made from either side of the board. Use a needle-point probe to penetrate to the wiring whenever a protective coating is used on the wiring. A brass probe can be soldered to an alligator clip adapted to measuring instrument.

3. Always use a heat sink when soldering transistors; a transistor pad with mounting feet is an effective heat sink.

4. Broken or damaged printed wiring is usually the result of an imperfection, strain or careless soldering. To repair small breaks, tin a short piece of hook-up wire to bridge the break, and holding the wire in place, flow solder along the length of wire so that it becomes part of the circuitry.

5. When unsoldering components from the board never pry or force loose the part; unsolder the component by using the wicking process described below:

   a) Select a 3/16 inch tinned copper braid for use as a wick; if braid is not available, select AWG No. 14 or No. 16 stranded wire with 1/2 inch insulation removed.

   b) Dip the wick in liquid rosin flux.

   c) Place the wick onto the soldered connection and apply soldering iron onto the wick.

   d) When sufficient amount of solder flows onto the wick, freeing the component, simultaneously remove iron and wick.

TROUBLE CHART

The trouble chart is intended as a guide for locating trouble causes and is used along with the schematic diagram.

The operating conditions assumed for the trouble chart are as follows:

a) AC power of proper voltage and frequency is present at input terminals.

b) Either possitive or negative terminal is connected to chassis ground.

c) The power supply is connected for constant voltage with local sensing. See schematic; dotted lines indicate jumpers connected for local sensing operation.

SAFETY NOTICE

DANGEROUS VOLTAGES EXIST IN THIS EQUIPMENT. OBSERVE THE USUAL SAFETY PRECAUTIONS WHEN OPERATING OR SERVICING THE EQUIPMENT TO AVOID SHOCK OR INJURY.

TROUBLE SHOOTING CHART

Symptom	Possible Cause	Remedy
1. Zero volts DC output, voltage across C1, C2 reads zero.	Open F1, CR7, CR8, CR103, CR144, R15, SCR5, SCR6	Check and replace as necessary.
2. Same as 1, voltage across C1, C2 is correct, voltage across C104 is zero.	Thermostat S1 closed.	Refer to table 1 of SPECIFICATIONS AND FEATURES for current ratings at given ambient temperature. After allowing time for the power supply to cool, resume operation of the supply.

TROUBLE SHOOTING CHART

Symptom	Possible Cause	Remedy
	SCR101 fired due to OV condition.	Interrupt AC input for twenty seconds. If supply operates normally, a transient has occurred, check wiring (switches, etc.). If supply fails to reach full output voltage, remove AC input, disconnect +V terminal of HC1, remove load, apply AC power and refer to procedure for: Output Too High "Symptom 4."
	R1 open, CR129 shorted.	Check and replace as necessary.
3. Same as 1, voltage across C1, C2 and C104 are correct.	Q1, Q2, Q3, Q4, R5 open.	Check and replace as necessary.
4. Output voltage too high.	Open sense lead.	Check load and load connections, correct as necessary.
	Defective HC101. Open R119, R19, R130, CR122 — CR125	Check and replace as necessary.
5. Very low output voltage, voltage across C104 reads correct.	R126, R127 open. HC101, SCR101 defective.	Check and replace as necessary.
6. High ripple.	Defective HC101, C3.	Replace as required.

PERFORMANCE CHECKS

Check the ripple and regulation of the power supply using the test connection diagram shown in figure 9. Use suggested test equipment or equivalent to obtain accurate results. Refer to SPECIFICATIONS AND FEATURES for minimum performance standards.

Set the differential meter, DC DVM (John Fluke Model 891A or equivalent) to the selected power supply operating voltage. Check the power supply load regulation accuracy while switching from the no load to load condition. Long load leads should be a twisted pair to minimize AC pick-up.

Use a Variac to vary the line voltage from 187-242, 242-187, 205-265, or 265-205 volts AC and check the power supply line regulation accuracy on the DVM differential meter.

Use a TVM, John Fluke Model 931B or equivalent, to measure rms ripple voltage of the power supply DC output. Use oscilloscope to measure peak-to-peak ripple voltage of the power supply DC output.

ADJUSTMENT OF CALIBRATION CONTROL R125.

Whenever HC101, R5, or R125 are replaced, and voltage and current indications do not reflect maximum ratings, adjust R125 as follows. The adjustment procedure requires that the power supply is removed from associated equipment, is at an ambient temperature of 25-30° C, and is stabilized and not operating.

1. Remove AC input power to the supply.

2. Break seal on wiper of R125 from resistor housing and turn to full CW position.

3. Operate power supply for constant voltage with local sensing connected as shown in figure 3, with no external load, and with AC input of 242 or, as applicable, 265 VAC, 60 Hz.

4. Turn voltage adjust control until minimum rated output voltage is obtained.

5. Apply load so that output current is 105-110% of 40° C rating for the unit.

6.* Using an oscilloscope, Tektronix 503 or equivalent, observe output voltage while adjusting R125 in CCW direction. Adjust R125 until output ripple frequency decreases sharply. Readjust R125 in CW direction until output ripple frequency increases sharply.

7.* After adjustment is completed, remove AC power input to the supply and use glyptol sealant to seal wiper of R125 to resistor housing.

8.* After sealing, check setting and repeat adjustment procedure if required.

* Perform alternate steps 6A through 8A for adjustment of R125 on models LGS-6V-5-OV-R and LGS-6V-6-OV-R.

6A. Using an oscilloscope, Tektronix 503 or equivalent, observe output voltage while adjusting R125 in CCW direction. Adjust R125 until output ripple increases sharply and oscilloscope pattern changes.

7A. After adjustment is completed, remove AC power input to the supply and use glyptol sealant to seal wiper of R125 to resistor housing.

8A. After sealing, check setting and repeat adjustment procedure if required.

SERVICE

When additional instructions are required or repair service is desired, contact the nearest Lambda office where trained personnel and complete facilities are ready to assist you.

Please include the power supply model and serial number together with complete details of the problem. On receipt of this information, Lambda will supply service data or advise shipping for factory repair service.

All repairs not covered by the warranty will be billed at cost and an estimate forwarded for approval before work is started.

PARTS ORDERING

Standard components and special components used in the Lambda power supply can be obtained from the factory. In case of emergency, critical spare parts are available through any Lambda office.

The following information must be included when ordering parts:

1. Model number and serial number of power supply and purchase date.
2. Lambda part number.
3. Description of part together with circuit designation.
4. If part is not electronic part, or is not listed, provide a description, function, and location, of the part.

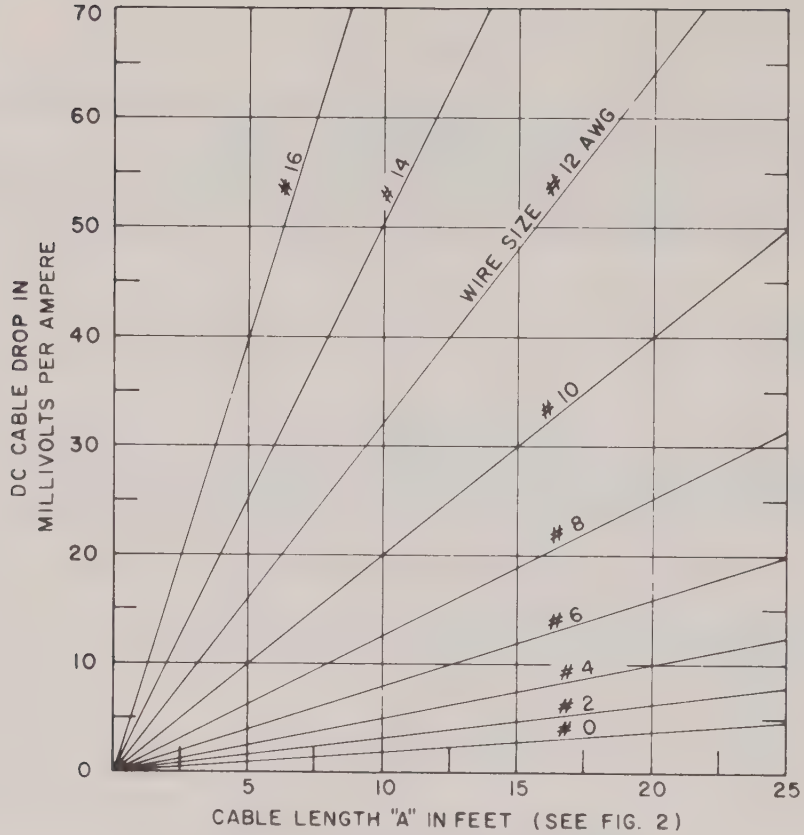


Figure 1. Cable Connection Chart.

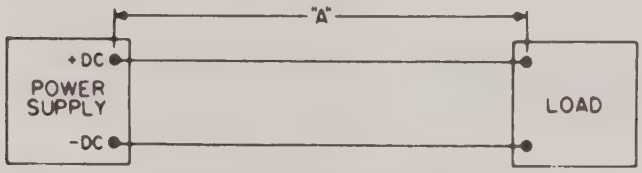
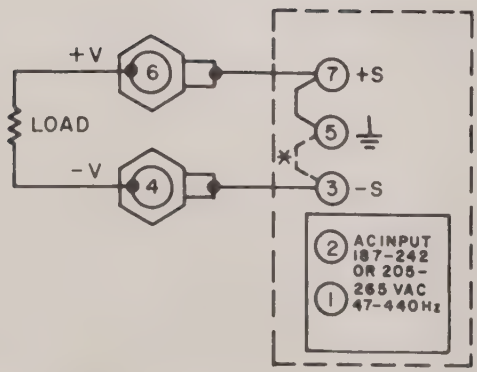


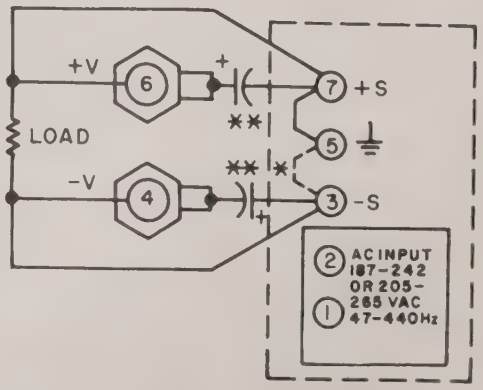
Figure 2. Cable Length "A" in Feet.



NOTE

* FOR NEGATIVE GROUND, DISCONNECT JUMPER FROM TERMINALS 5 AND 7 AND RECONNECT TO TERMINALS 5 AND 3.

Figure 3. Local Sensing Connections.

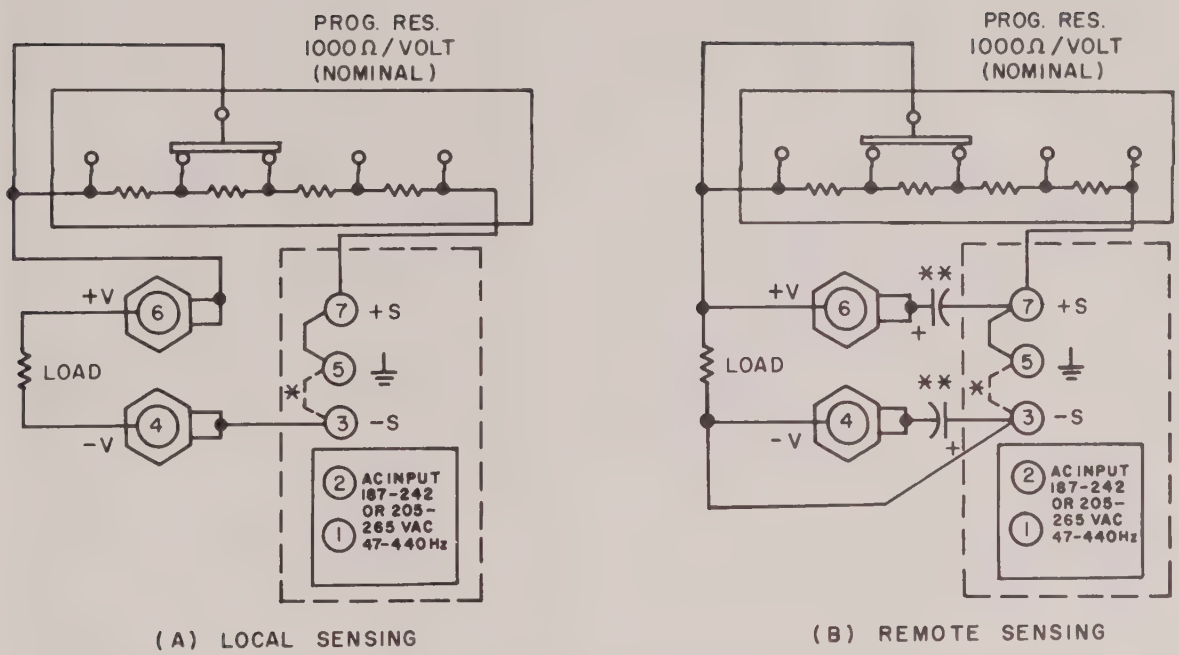


NOTE

* FOR NEGATIVE GROUND, DISCONNECT JUMPER FROM TERMINALS 5 AND 7 AND RECONNECT TO TERMINALS 5 AND 3.

** A 2.5MF, ELECT., CAP. MAY BE REQUIRED.

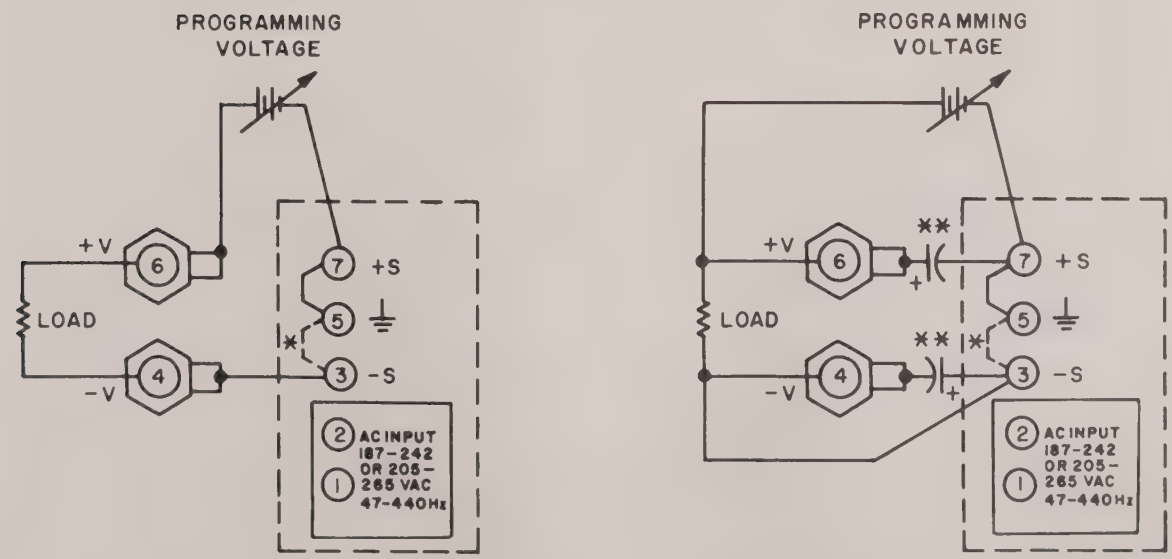
Figure 4. Remote Sensing Connections.



NOTES: * FOR NEGATIVE GROUND, DISCONNECT JUMPER FROM TERMINALS 5 AND 7 AND RECONNECT TO TERMINALS 3 AND 5.

** A 2.5MF, ELECT., CAP. MAY BE REQUIRED.

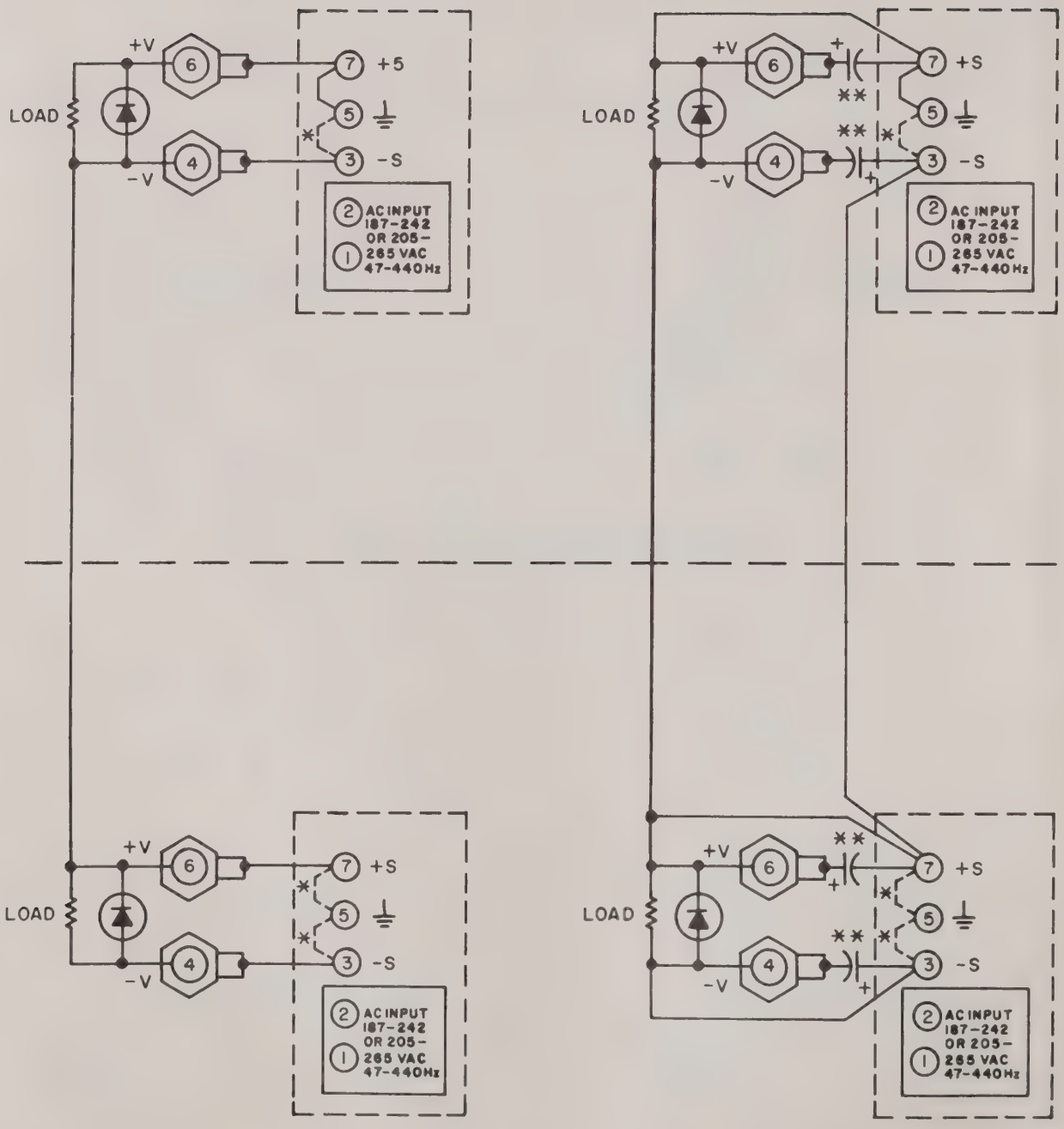
Figure 5. Programmed Voltage, With External Resistor.



NOTES: * FOR NEGATIVE GROUND, DISCONNECT JUMPER FROM TERMINALS 5 AND 7 AND RECONNECT TO TERMINALS 3 AND 5.

** A 2.5MF, ELECT., CAP. MAY BE REQUIRED.

Figure 6. Programmed Voltage, With External Programming Voltage Source.



(A) LOCAL SENSING

(B) REMOTE SENSING

NOTES:

* MAKE ONLY ONE GROUND CONNECTION FOR SERIES COMBINATION. TO CHANGE GROUND AS SHOWN, REMOVE JUMPER FROM TERMINALS 5 AND 7 ON TOP UNIT AND CONNECT ANY ONE OF THE OTHER JUMPERS AS SHOWN IN DOTTED LINE.

** A 2.5MF, ELECT., CAP. MAY BE REQUIRED.

Figure 7. Series Connection.

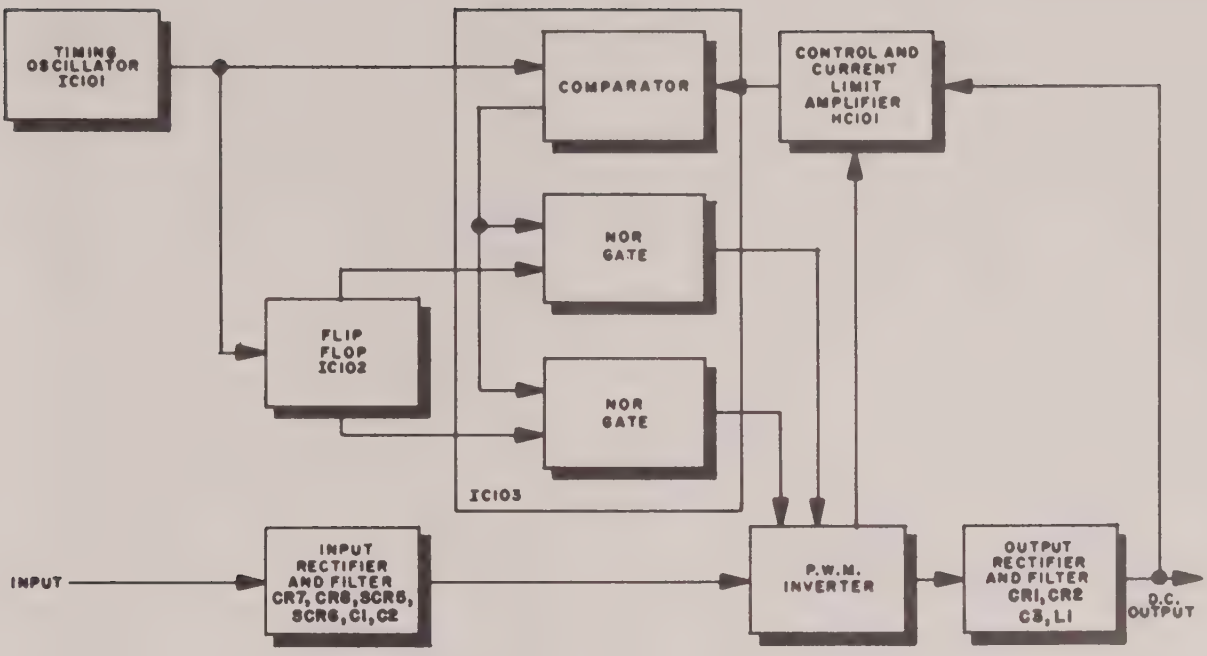


Figure 8. Typical Block Diagram.

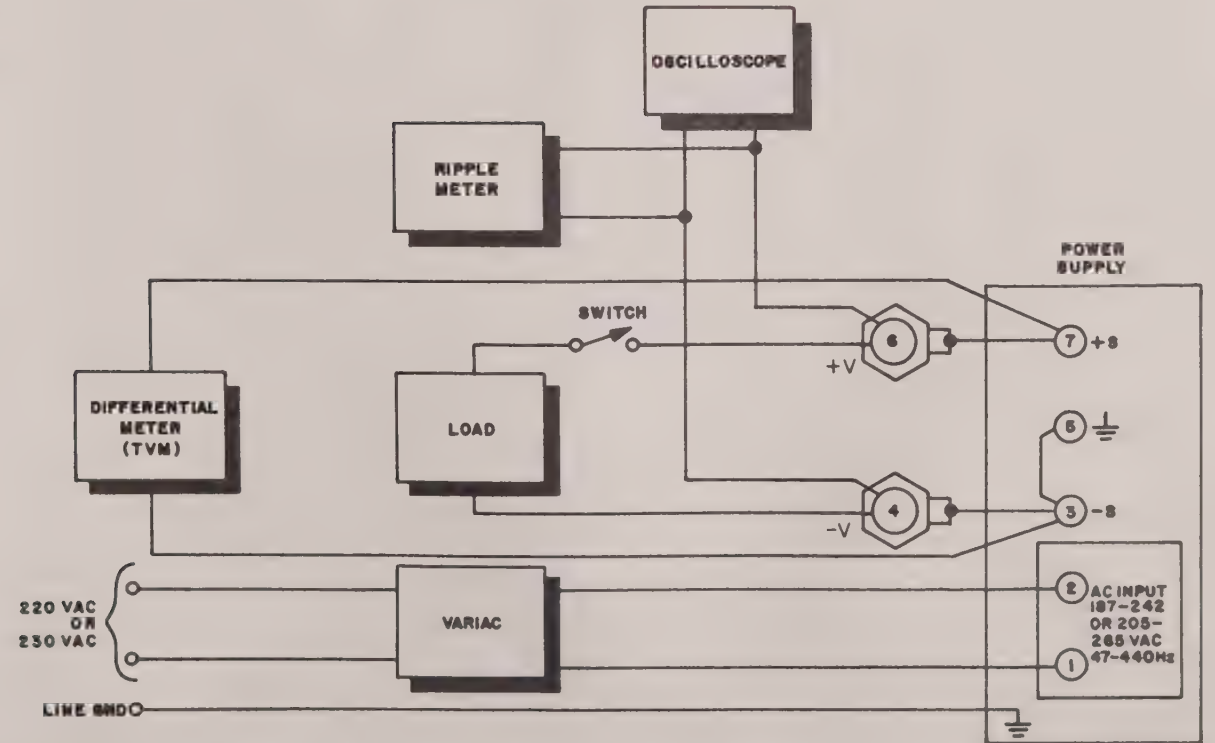


Figure 9. Test Connections for Performance Checks.

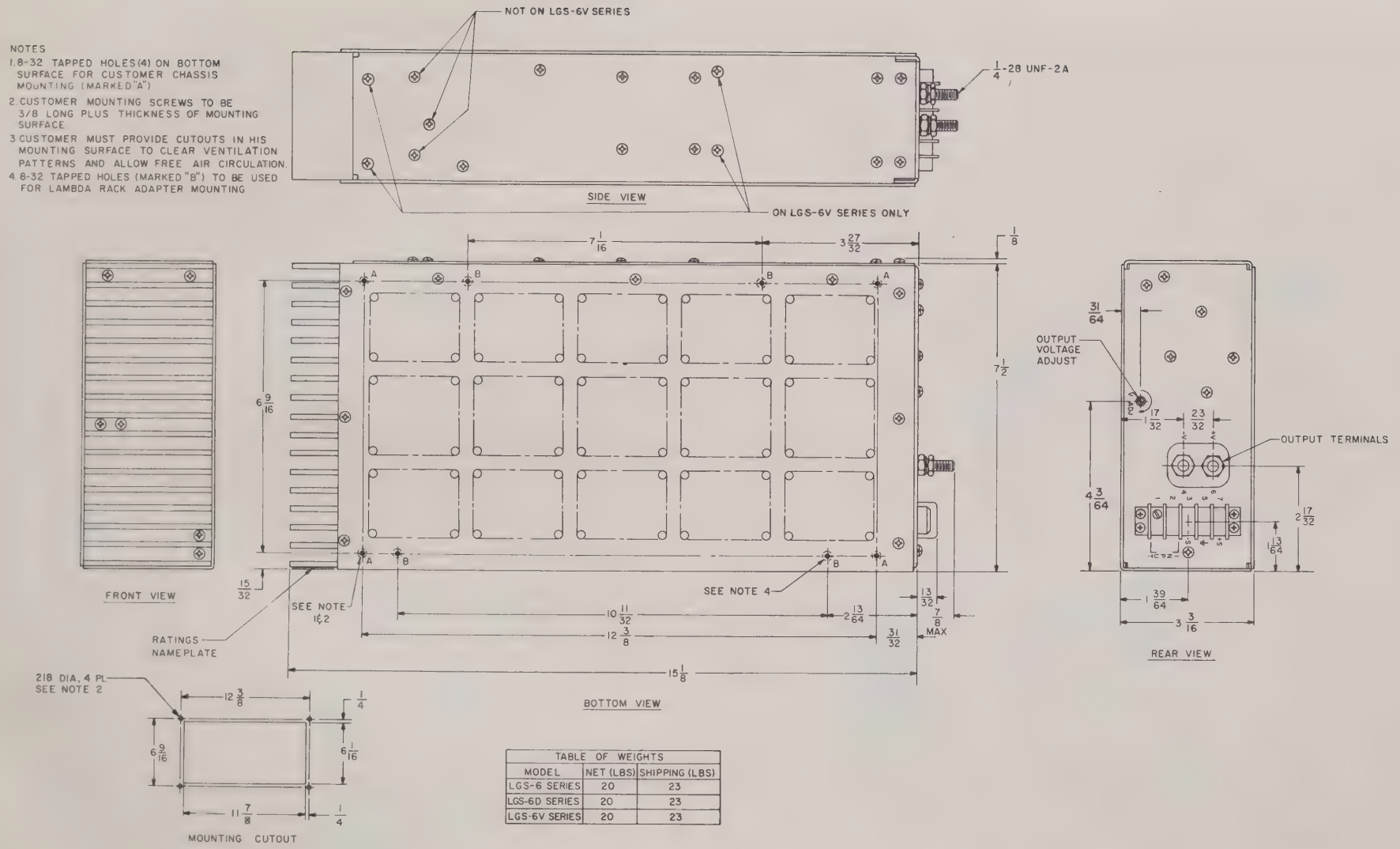

NOTES
1. 8-32 TAPPED HOLES (4) ON BOTTOM SURFACE FOR CUSTOMER CHASSIS MOUNTING (MARKED "A")
2. CUSTOMER MOUNTING SCREWS TO BE 3/8 LONG PLUS THICKNESS OF MOUNTING SURFACE
3. CUSTOMER MUST PROVIDE CUTOUTS IN HIS MOUNTING SURFACE TO CLEAR VENTILATION PATTERNS AND ALLOW FREE AIR CIRCULATION.
4. 8-32 TAPPED HOLES (MARKED "B") TO BE USED FOR LAMBDA RACK ADAPTER MOUNTING
NOT ON LGS-6V SERIES
1/4-28 UNF-2A
SIDE VIEW
ON LGS-6V SERIES ONLY
FRONT VIEW
RATINGS NAMEPLATE
SEE NOTE 1&2
SEE NOTE 4
BOTTOM VIEW
OUTPUT VOLTAGE ADJUST
OUTPUT TERMINALS
REAR VIEW
218 DIA. 4 PL SEE NOTE 2
MOUNTING CUTOUT

TABLE OF WEIGHTS		
MODEL	NET (LBS)	SHIPPING (LBS)
LGS-6 SERIES	20	23
LGS-6D SERIES	20	23
LGS-6V SERIES	20	23

Figure 10. Outline Drawing.

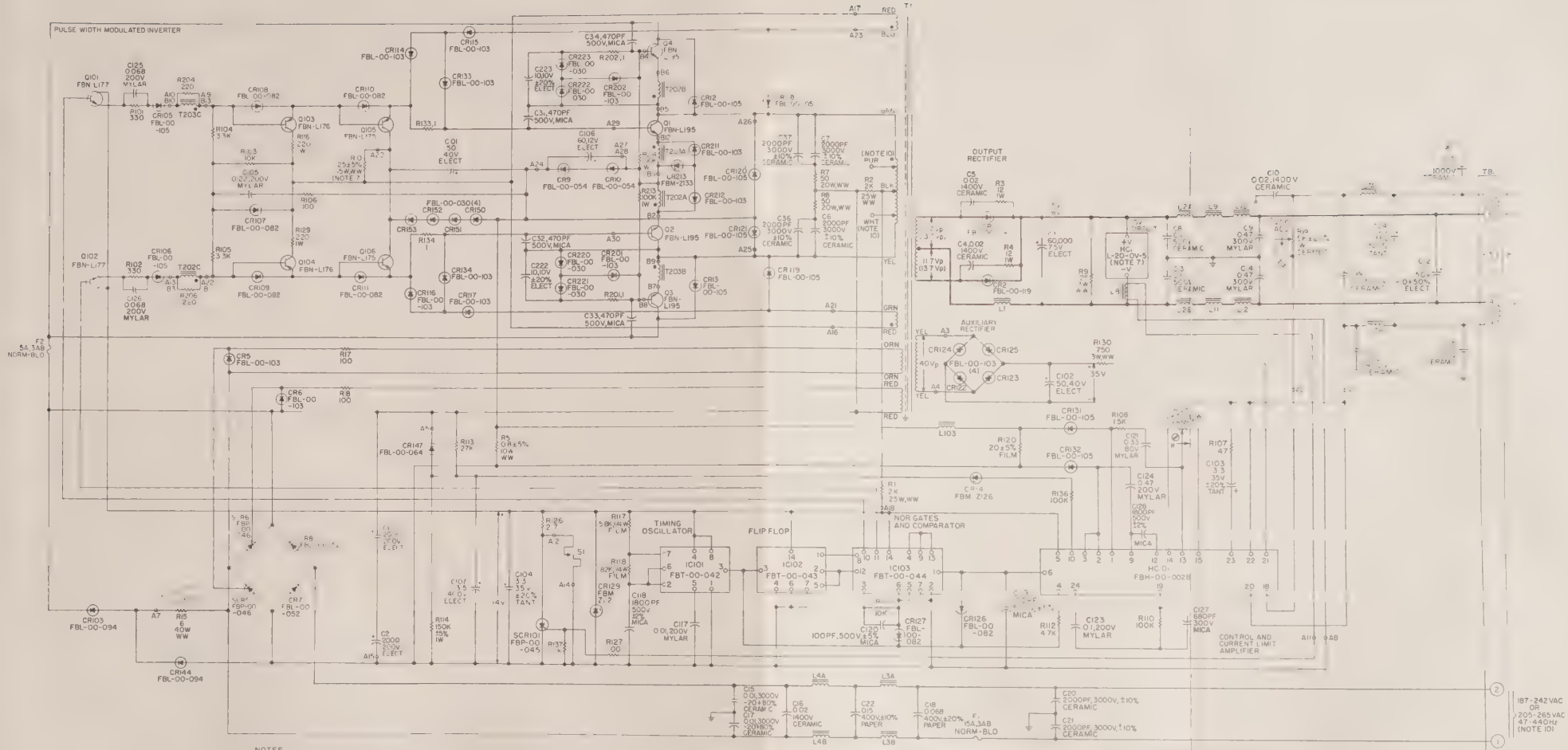
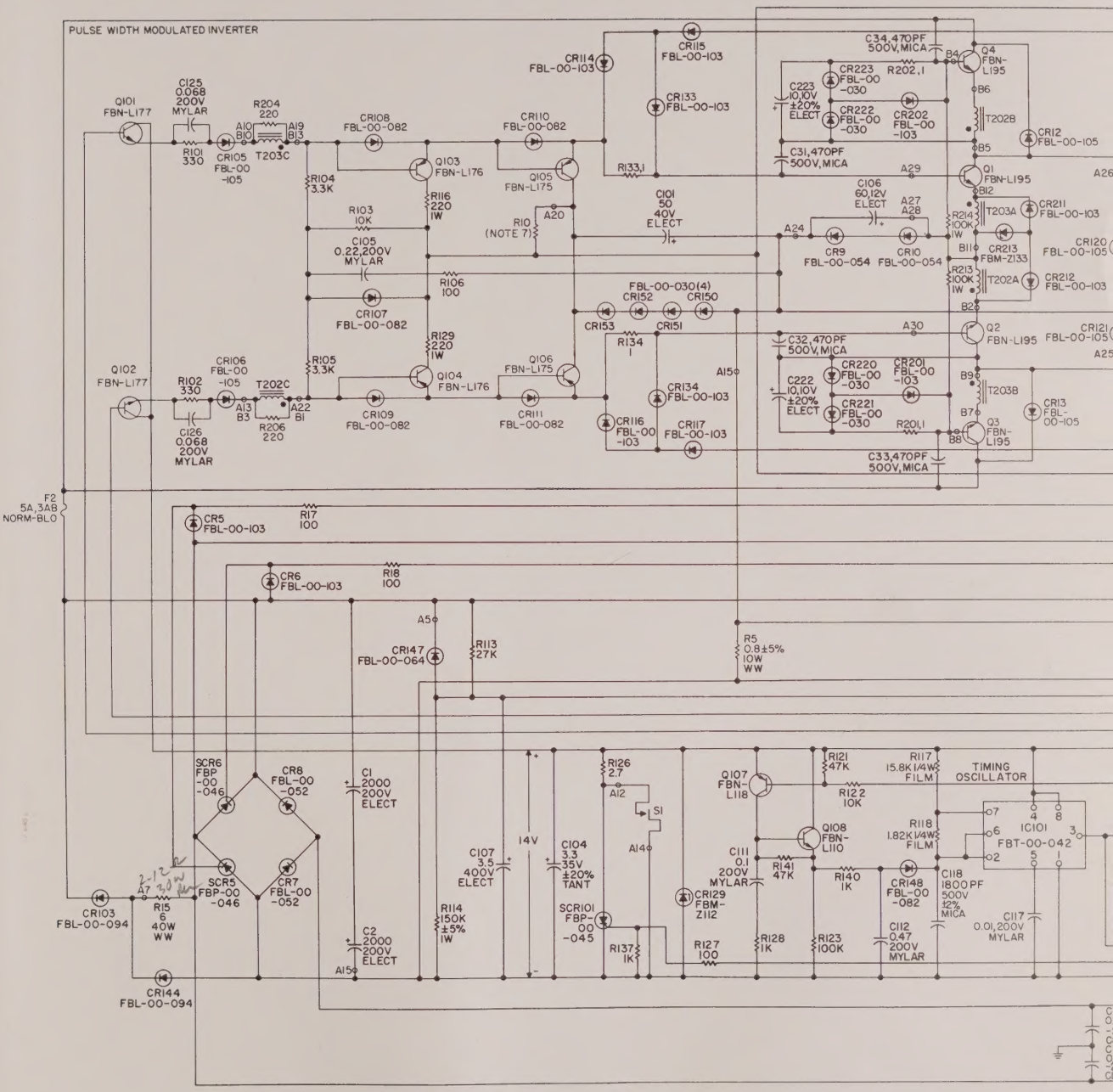

PULSE WIDTH MODULATED INVERTER
OUTPUT RECTIFIER
AUXILIARY RECTIFIER
TIMING OSCILLATOR
FLIP FLOP
NOR GATES AND COMPARATOR
CONTROL AND CURRENT LIMIT AMPLIFIER
187-242 VAC OR 205-265 VAC 47-440Hz (NOTE 10)
F2 5A,3AB NORM-BLO
F1 15A,3AB NORM-BLO
Q101 FBN L177
Q102 FBN-L177
Q103 FBN-L176
Q104 FBN-L176
Q105 FBN-L175
Q106 FBN-L175
Q1 FBN-L195
Q2 FBN-L195
Q3 FBN-L195
Q4 FBN
IC101 FBT-00-042
IC102 FBT-00-043
IC103 FBT-00-044
SCR101 FBP-00-045
CR103 FBL-00-094
CR144 FBL-00-094
CR147 FBL-00-064
CR129 FBM Z7.2
CR4 FBM Z26
T203C
T202C
T202B
T202A
T203B
T203A
T1
T8
L1
L2
L103
L4A
L3A
L4B
L3B
L48
L38
NOTES
1 RESISTORS ARE 1/2W COMP. WITH VALUES IN OHMS UNLESS OTHERWISE NOTED.
2 CAPACITOR VALUES ARE IN MICROFARADS UNLESS OTHERWISE NOTED.
3 RESISTOR TOLERANCES: COMP ±10%, FILM ±1%, WIREWOUND ±3%.
4 CAPACITOR TOLERANCES: ELECTROLYTIC -10 +100%, CERAMIC ±20%, MYLAR ±10%, MICA ±10% UNLESS OTHERWISE NOTED.
5 SYMBOLS
INDICATES ACTUAL UNIT MARKING
INDICATES CLOCKWISE ROTATION OF SHAFT.
* SEE INSTRUCTION MANUAL
INDICATES TERMINAL ON PRINTED WIRING BOARD OR TERMINAL BOARD
INDICATES ADJUSTMENT OR CALIBRATION CONTROL
6. DESIGNATIONS ARE LAMBDA PART NUMBERS
7. ON MODEL LGS-6V-6-OV-R: HC1 IS L-20-OV-6 AND R10 IS 20±5%, 15W, WW
8. CONDITIONS FOR CIRCUIT POINT MEASUREMENTS: INPUT 220VAC (WIRED FOR 187-242V) OR 230VAC (WIRED FOR 205-265V) 57-63Hz. OUTPUT NOMINAL VOLTAGE, NO LOAD +S AND +V SHORTED, -S AND -V SHORTED INDICATED VOLTAGES ARE TYPICAL VALUES AND ARE DC UNLESS OTHERWISE NOTED. DC MEASUREMENTS TAKEN WITH 20,000 OHMS/V VOLTMETER. AC MEASUREMENTS ARE PEAK VALUES MEASURED WITH OSCILLOSCOPE. VOLTAGES ARE TAKEN BETWEEN INDICATED POINTS AND -S ITERM 3) UNLESS OTHERWISE NOTED. VOLTAGES IN PARENTHESIS APPLY TO MODEL LGS-6V-6-OV-R. A SINGLE READING APPLIES TO BOTH MODELS.
9. THE FOLLOWING WAVEFORMS CAN BE OBSERVED BETWEEN INDICATED POINTS AND -S UNLESS OTHERWISE NOTED
IC101, PIN 3
IC102, PIN 1
IC102, PIN 2
IC103, PIN 1
IC103, PIN 10
IC103, PIN 11
SECONDARIES OF T1 (MEASURED BETWEEN POINTS INDICATED ON DIAGRAM WITH OUTPUT LOADED TO 10% OF RATED CURRENT MINIMUM)
13 V
0 V
10. T1 HAS TAPPED PRIMARY UNIT CAN BE WIRED FOR 187-242V INPUT (USING BRN AND BLU LEADS) OR FOR 205-265V INPUT (USING BRN AND WHT (NOTE 10) LEADS).
FOR WIRING OF POWER SUPPLY LOAD WIRING DIAGRAMS.
DOTTED CONNECTIONS SHOWN ON TB1 INDICATE JUMPERS IN PLACE FOR LOCAL SENSING CONNECTION
THIS SCHEMATIC APPLIES TO UNITS BEARING SERIAL NO PREFIX A
SCHEMATIC DIAGRAM
REGULATED POWER SUPPLY
LAMBDA
ELECTRONICS
MELVILLE, NEW YORK
A DIVISION OF Veeco INSTRUMENTS INC

TABLE I
SCHEMATIC DATA REFERENCES
MODELS LGS-6V-12-OV-R THRU LGS-6V-28-OV-R

Models	Schematic Voltage Measurements		Schematic Components								
			C3	C4, C5	CR1, CR2	HC1	R3, R4	R9	R10	R19	R119
	A (Vp)	B (VDC)	-10+100% ELECT	±20% CERAMIC	FBL-00-*	L-20-OV-*	±10%, 1w COMP.	5w WW	±5%, 15w WW	1w CERMET	±1%, ¼w FILM
LGS-6V-12-OV-R	21.0	12.0	40,000 mf 15 vdc	0.02 mf 1,400 vdc	118	12	22	100 ±3%	15	5K ±20%	7.5K
LGS-6V-15-OV-R	25.5	15.0	25,000 mf 25 vdc	0.02 mf 1,400 vdc	118	15	22	100 ±3%	15	5K ±20%	10K
LGS-6V-20-OV-R	36.3	20.0	18,000 mf 30 vdc	0.01 mf 1,000 vdc	140	20	33	150 ±5%	20	10K ±10%	13.3K
LGS-6V-24-OV-R	43.5	24.0	14,000 mf 40 vdc	0.01 mf 1,000 vdc	140	24	33	150 ±5%	15	10K ±10%	18.2K
LGS-6V-28-OV-R	49.0	28.0	14,000 mf 40 vdc	0.01 mf 1,000 vdc	140	28	33	220 ±3%	20	10K ±10%	20K

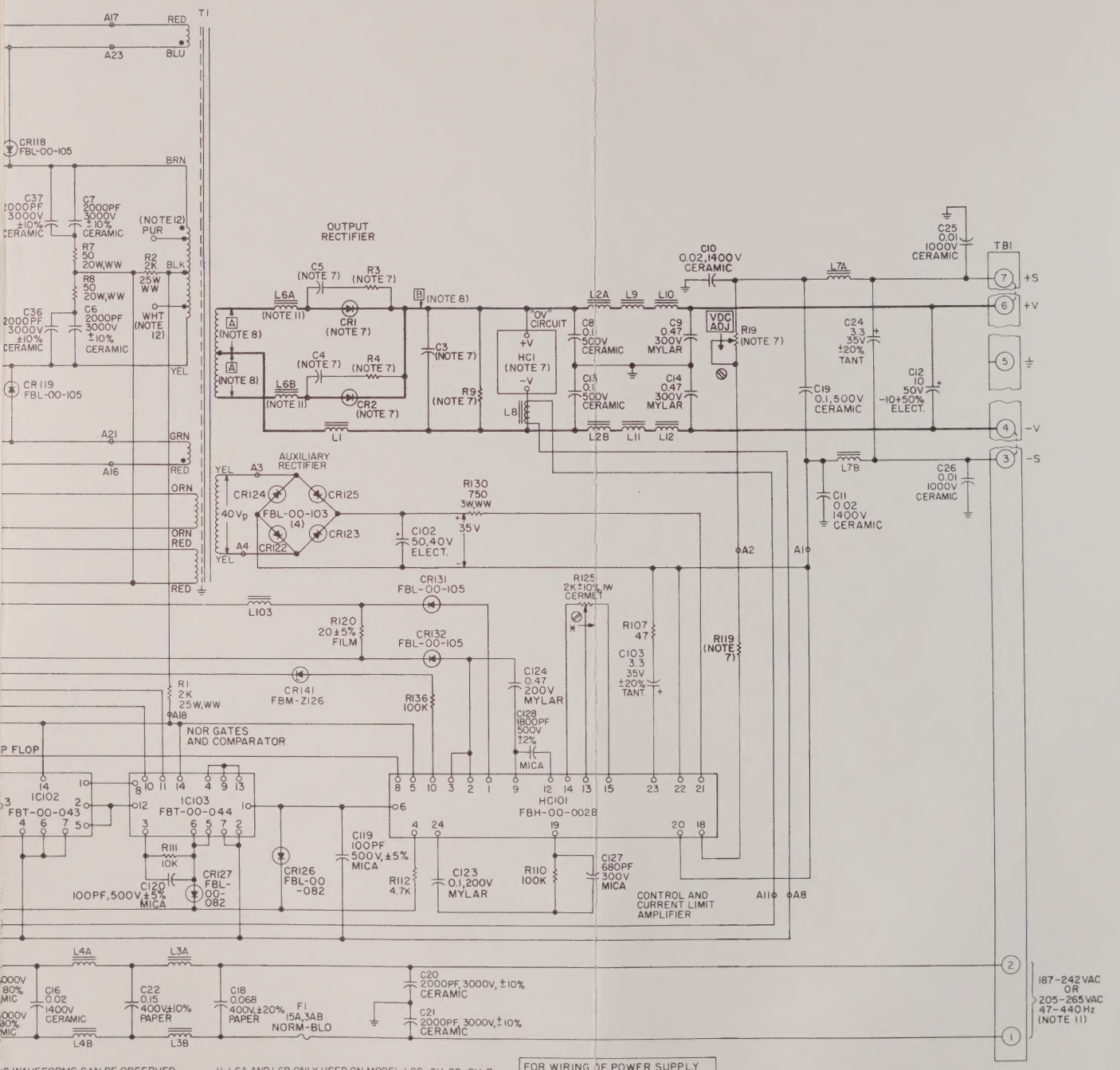
*Lambda part no.



NOTES

1. RESISTORS ARE 1/2W COMP. WITH VALUES IN OHMS UNLESS OTHERWISE NOTED.
2. CAPACITOR VALUES ARE IN MICROFARADS UNLESS OTHERWISE NOTED.
3. RESISTOR TOLERANCES: COMP. ±10%, FILM ±1%, WIREWOUND ±3%
4. CAPACITOR TOLERANCES: ELECTROLYTIC −10 +100%, CERAMIC ±20%, MYLAR ±10%, MICA ±10% UNLESS OTHERWISE NOTED.
5. SYMBOLS.
   - ▭ INDICATES ACTUAL UNIT MARKING.
   - ↓ INDICATES CLOCKWISE ROTATION OF SHAFT.
   - * SEE INSTRUCTION MANUAL
   - ⊸ INDICATES TERMINAL ON PRINTED WIRING BOARD OR TERMINAL BOARD.
   - ⊘ INDICATES ADJUSTMENT OR CALIBRATION CONTROL.
6. DESIGNATIONS ARE LAMBDA PART NUMBERS.
7. SEE TABLE I FOR COMPONENT VALUES.
8. SEE TABLE I FOR VOLTAGE VALUES.
9. CONDITIONS FOR CIRCUIT POINT MEASUREMENTS: INPUT: 220VAC (WIRED FOR 187-242V) OR 230 VAC (WIRED FOR 205-265V), 57-63 Hz. OUTPUT: NOMINAL VOLTAGE, NO LOAD. +S AND +V SHORTED, −S AND −V SHORTED. INDICATED VOLTAGES ARE TYPICAL VALUES AND ARE DC UNLESS OTHERWISE NOTED. DC MEASUREMENTS TAKEN WITH 20,000 OHMS/V VOLTMETER. AC MEASUREMENTS ARE PEAK VALUES MEASURED WITH OSCILLOSCOPE. VOLTAGES ARE TAKEN BETWEEN INDICATED POINTS AND −S (TERM. 3) UNLESS OTHERWISE NOTED.
10. THE FOLLO... BETWEEN I... OTHERWISE
    - IC101, PIN ...
    - IC102, PIN ...
    - IC102, PIN ...
    - IC103, PIN ...
    - IC103, PIN ...
    - IC103, PIN ...

SECONDAR... OF T1 (MEASURE... BETWEEN... POINTS INDICATED... DIAGRAM. OUTPUT L... TO10% OF... CURRENT



11. L6A AND L6B ONLY USED ON MODEL LGS-6V-20-0V-R THRU LGS-6V-28-0V-R.
12. T1 HAS TAPPED PRIMARY. UNIT CAN BE WIRED FOR 187-242V INPUT (USING PUR AND WHT TRANSFORMER LEADS) OR FOR 205-265 V INPUT (USING BRN AND YEL TRANSFORMER LEADS.

FOR WIRING OF POWER SUPPLY TO LOAD REFER TO SUPPLY-TO-LOAD WIRING DIAGRAMS.

DOTTED CONNECTIONS SHOWN ON TB1 INDICATE JUMPERS IN PLACE FOR LOCAL SENSING CONNECTION.

THIS SCHEMATIC APPLIES TO UNITS BEARING SERIAL NO. PREFIX A

SCHEMATIC DIAGRAM REGULATED POWER SUPPLY

MODELS
LGS-6V-12-0V-R
LGS-6V-15-0V-R
LGS-6V-20-0V-R
LGS-6V-24-0V-R
LGS-6V-28-0V-R

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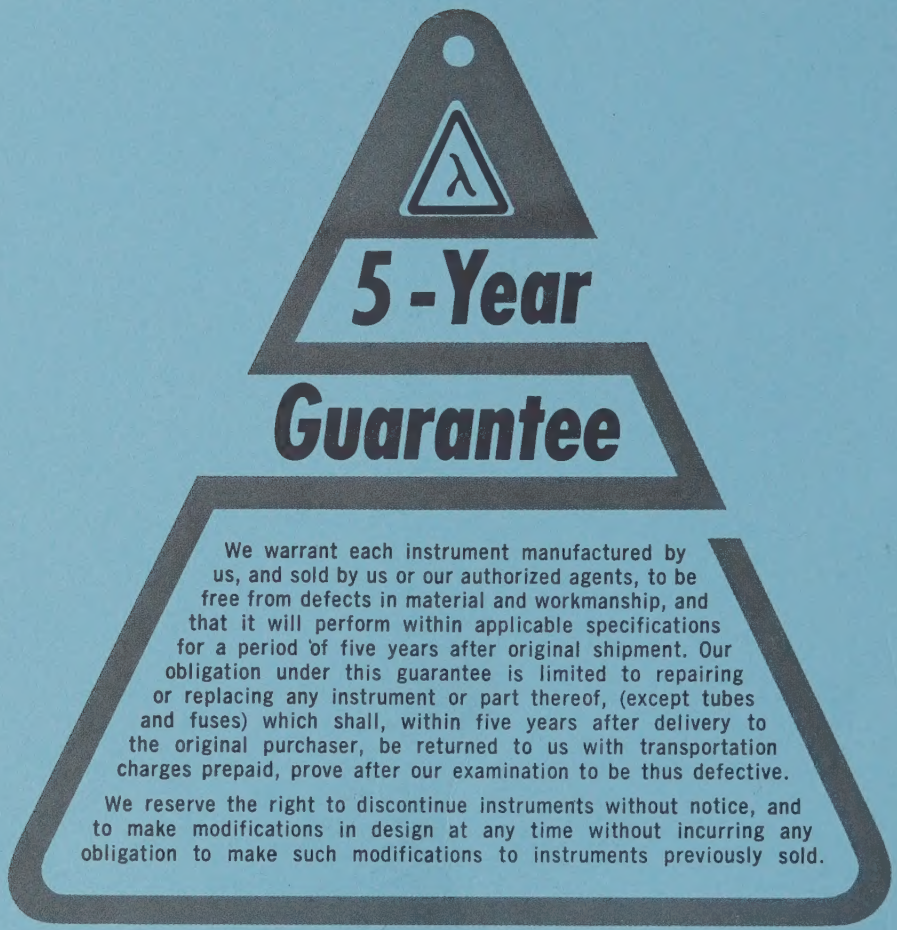
5 - Year
Guarantee
We warrant each instrument manufactured by us, and sold by us or our authorized agents, to be free from defects in material and workmanship, and that it will perform within applicable specifications for a period of five years after original shipment. Our obligation under this guarantee is limited to repairing or replacing any instrument or part thereof, (except tubes and fuses) which shall, within five years after delivery to the original purchaser, be returned to us with transportation charges prepaid, prove after our examination to be thus defective.
We reserve the right to discontinue instruments without notice, and to make modifications in design at any time without incurring any obligation to make such modifications to instruments previously sold.

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IM-LGS-6V